Small Business Innovation Research/Small Business Tech Transfer

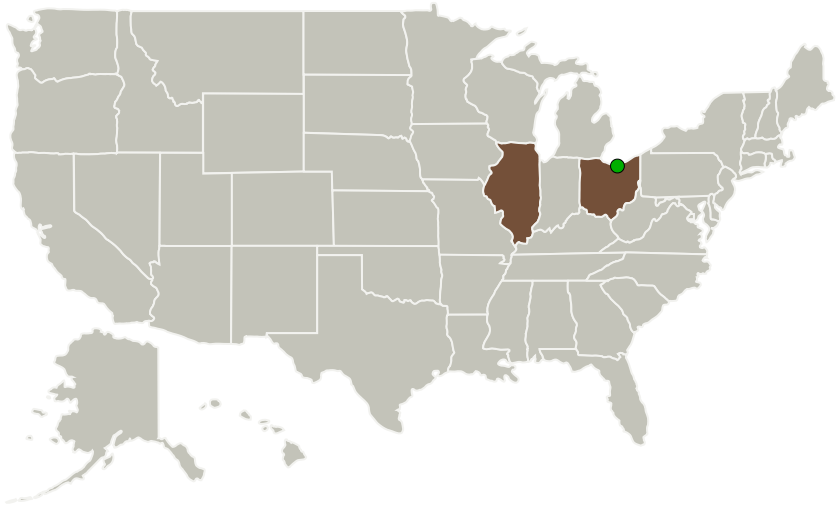
Highly Conductive Polymer Electrolyte Impregnated 3d Li-Metal Negative Electrode, Phase I

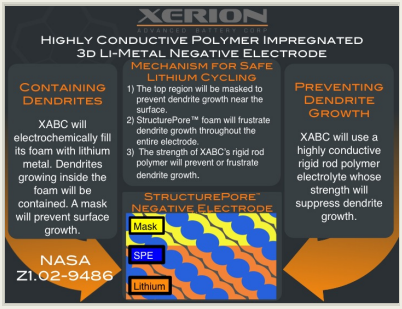
Completed Technology Project (2014 - 2014)

Project Introduction

XABC (Xerion Advanced Battery Corp) proposes a novel anode with three unique features, each designed to 1) control or 2) prevent dendrite growth. The first feature is a 95% porous electrode architecture. This electrode is an open-cell, nanostructured conductive foam whose internal structures are conformal coated with lithium metal. Dendrites growing outward from an internal pore surface will propagate until they come into contact with an opposing wall inside the foam and further growth is mechanically frustrated. This prevents dendrites from propagating external to the anode, as the dendrites would be trapped within the structure of the foam. The second feature is a five micron mask that, when applied to the surface of the 3d foam, prevents electrodeposition of lithium metal near the surface of the electrode, hence preventing growth of lithium dendrites near the surface. The third feature is a novel, highly conductive ionic fluid rigid-rod polymer composite expected to achieve a conductivity of 8.3x10^-3 S/cm^2. This polymer has already demonstrated protonic conductivity of 8.3x10^-3 S/cm^2 and must be modified for use in a lithium ion battery. Rigid-rod polymers have a tensile modulus that is 37x – 62x stronger than a standard polyethelyene solid polymer electrolyte. This strength may physically deter or altogether prevent the growth of lithium dendrites. XABC believes that the novel combination of these three unique features will enable the stable cycling of lithium metal in a secondary cell. For Phase I, XABC proposes to fabricate and test the effect of both the polymer and masked 3d foam on dendrite suppression. For Phase II, XABC proposes to fabricate fully functioning negative electrodes with the features above.

Primary U.S. Work Locations and Key Partners





Highly Conductive Polymer Electrolyte Impregnated 3d Li-Metal Negative Electrode Project Image

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Organizations Performing Work	Role	Type	Location
Xerion Advanced Battery	Lead Organization	Industry Small Disadvantaged Business (SDB)	Champaign, Illinois
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Illinois	Ohio

Project Transitions

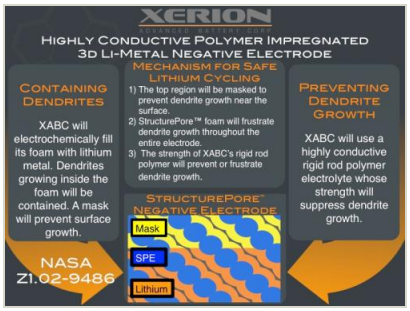
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137665)*

Images



Project Image
Highly Conductive Polymer Electrolyte Impregnated 3d Li-Metal Negative Electrode Project Image *(https://techport.nasa.gov/image/129417)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Xerion Advanced Battery

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

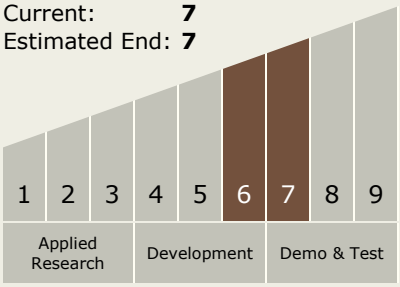
Carlos Torrez

Principal Investigator:

Thuy D Dang

Technology Maturity (TRL)

Start: **6**
Current: **7**
Estimated End: **7**



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Completed Technology Project (2014 - 2014)

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.1 Electrochemical: Batteries

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System